

## EC2400 Problem Set 9

1. Assuming “at rest” initial conditions, find the response of the difference equation

$$y[n] = -0.8y[n-1] + 5x[n]$$

when the input is  $x[n] = \cos(0.2\pi n)u[n]$ . Check your result by finding the complete response using z-transform methods.

2. Assuming “at rest” initial conditions, find the response of the difference equation

$$y[n] = \frac{5}{6}y[n-1] - \frac{1}{6}y[n-2] + \frac{1}{2}x[n] + \frac{1}{3}x[n-1]$$

when the input is  $x[n] = \cos((\pi/3)n)u[n]$ . Check your result by finding the complete response using z-transform methods.

3. Assuming “at rest” initial conditions, find the response of the difference equation

$$y[n] = y[n-1] - 0.5y[n-2] + 0.5x[n] + 0.5x[n-1]$$

when the input is  $x[n] = \cos((\pi/3)n)u[n]$ . Check your result by finding the complete response using z-transform methods.

4. Show the following properties of the z-transform:

- a. If  $y[n] = x[n] - x[n-1]$  then  $Y(z) = (1 - z^{-1})X(z)$

- b. If  $y[n] = \sum_{k=-\infty}^n x[k]$  then  $Y(z) = \frac{1}{1 - z^{-1}}X(z)$

c.

5. For each of the following, find the z-transform and indicate the *region of convergence* by drawing it shaded in the complex (z) plane.

- a.  $x[n] = (-1)^n u[n]$

- b.  $x[n] = \cos(\alpha\pi n)u[n]$

- c.  $x[n] = \sin(\alpha\pi n)u[n]$

- d.  $x[n] = \frac{1}{N} \sum_{k=0}^{N-1} \delta[n-k]$  (closed form)

- e.  $x[n] = (n+1)u[n]$